Demography of the Cabbage Tree Palm, *Livistona australis*

By

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Certificate of Authorship/Originality

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Nicholas Carlile

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Abstract

This thesis, the demography of the Cabbage Tree Palm, *Livistona australis*, investigated some of the vital statistics concerning seed production and germination, seedling establishment and survival, time taken to reach reproductive maturity, longevity and population structure of the species. Seed survival, germination and seedling establishment was studied at two sites, one mainland location and one on a predator-free island. Greenhouse germination returned 91% success, but this was reduced to 19% by invertebrate attack and infection from soil pathogens *in situ*. The germination of *in situ* seed was not significantly affected by light levels, but burial of seed increased germination threefold (from 17% to 52%) compared to seed on the soil surface. Germination rates were higher with the removal of the mesocarp, but only on an island. At the mainland site mesocarp removal reduced germination success due to predation by the Bush Rat, *Rattus fuscipes*. These same predators did not reduce seedling survival by the end of a 30-month study. Evidence suggested, however, that low seedling survival at this mainland site (20-34%) was caused by insufficient light for photosynthesis after exhaustion of resources from the seed. Less dense seedlings on an island had much higher survival (62%).

Two additional study sites were included in the investigation that compared rates of trunk growth, approximate age based on these growth rates and the flowering and fruiting patterns within and between the four populations. Morphological measurements showed that the taller the palm the larger the crown. The overall size of adult palms was strongly influenced by the local environment. In general, growth was fastest and

more variable prior to palms reaching reproductive age, after which the rate of growth declined and stabilised. The oldest palm was estimated to be 392 years old, and had a crown height of 14.9 metres. The mean age to first flowering from four populations was 170 years. Observations of senescence suggest that accident, by structural failure or breakage of the trunk, is the prime cause of death in natural palm populations. Between the four study sites there was differing distribution of the size classes of palm trunks. Two of the four populations indicated that any disturbance had not yet impacted on the distribution of trunk size classes at these sites. Of the other two sites one presented trunk frequencies that indicated a complex disturbance history while the other, an island study site, indicated that the impact brought about by 90 years of rabbit grazing had not yet become apparent.

This information can provide a basis from which to better manage populations of the species, particularly those at risk of decline due to isolation, harvesting of reproductive adults, frequent fires or other disturbance. Future research would be benefited from larger samples sizes than used here and by a more long-term study of seedling development. The estimation of the time taken for the development of the basal bulge remains the most difficult aspect of palm demographics.